

**POLARIZABILITIES AND HYPERPOLARIZABILITIES
FROM STUDIES OF THE TEMPERATURE DEPENDENCE
OF THE KERR EFFECT IN GASES AND VAPOURS**

By

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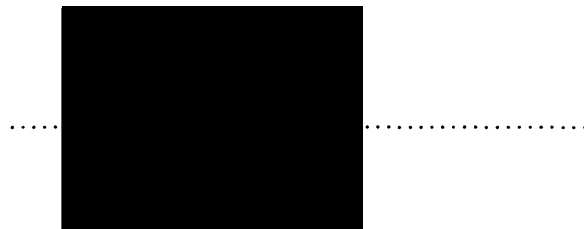
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PREFACE

This thesis describes research undertaken at the University of New England, under the supervision of Professor G.L.D. Ritchie.

I certify that the substance of this thesis has not already been submitted for any degree and is not currently being submitted for any other degree or qualification.

I certify that any help received in preparing this thesis, and all sources used, have been acknowledged in this thesis.



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ABSTRACT

The Kerr effect in gases and vapours is an important source of information about polarizabilities and hyperpolarizabilities, which describe the change in the electronic charge distribution of a molecule induced by an external electric field. Significant improvements made to the apparatus used to measure the temperature dependence of the Kerr effect, that increased the signal-to-noise ratio and the range of species that could be successfully investigated, are described in this thesis.

Kerr effect measurements were performed on ammonia, methylamine, dimethylamine, trimethylamine, methylacetylene, dimethylacetylene, bromomethane, dibromomethane, tribromomethane, tetrabromomethane, 1,2-difluorobenzene, 1,3-difluorobenzene, 1,4-difluorobenzene, 1,2,3,5-tetrafluorobenzene, 1,2,4,5-tetrafluorobenzene, pyridine and fluoroethane. Rayleigh light-scattering measurements were performed on 1,2-difluorobenzene and 1,3-difluorobenzene. The results from these studies were combined with other data to determine the polarizabilities, static polarizability anisotropies and the Kerr first and second hyperpolarizabilities of the molecules of interest. A procedure combining experiment and theory to obtain the polarizabilities of species with C_s symmetry in their equilibrium conformations is also described. The results are discussed in terms of the structures of the molecules, and the effects of atomic and functional-group substitution on the above properties are examined in detail.

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